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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/943,150
Filing Date: August 30, 2001
Appellant(s): DELUCA ET AL.

Barry L. Kelmachter
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 21 March 2007 appealing from the Office action mailed 19 October 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US 5,366,695	ERICKSON	11-1994
US 4,302,256	KENTON	11-1981

US 5,605,584 DELUCA et al 2-1997

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

---Claims 1, 4-11 and 24-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erickson (US 5,366,695) in view of Kenton (US 4,302,256) and DeLuca et al (US 5,605,584).

Erickson teaches (see abstract and title) a single crystal nickel-based superalloy that contains 1.8-4.0 wt% Cr, 0.25-2.0 wt% Mo, 3.5-7.5 wt% W, *about* 5.0-7.0 wt% Re, 7.0-10.0 wt% Ta, 5.0-7.0 wt% Al, 1.5-9.0 wt% Co, 0-0.15 wt% Hf, 0-0.5 wt% Nb (columbium), 0.1-1.2 wt% Ti and the balance Ni. Erickson further teaches (see col 2, lines 44-56) that the alloy may contain 0-0.04 wt% C, 0-0.01 wt% B, 0-0.01 wt% Zr and 0-0.1 wt% V. This composition overlaps the presently claimed range at 3.0-4.0 wt% Cr, 0.25-2.0 wt% Mo, 3.5-7.5 wt% W, *about* 5.0 wt% Re, 7-10 wt% Ta, 5-7 wt% Al, 1.5-9.0 wt% Co, 0-0.04 wt% C, 0-0.01 wt% B, 0-0.01 wt% Zr, 0-0.15 wt% Hf, 0-0.5 wt% Nb, 0-0.1 wt% V and 0.1-0.7 wt% Ti. Regarding the presence of at least one of Ru, Rh, Pd, Os, Ir and Pt, the present claim recites a range of "up to 10 wt%" which includes zero addition of the element. Erickson teaches (see table 4) that the process includes a step of solutionizing wherein up to 100% of the γ' (i.e.-all the γ') is taken into solution. Thus, the superalloy of Erickson is free from eutectic $\gamma - \gamma'$. The composition taught by Erickson does not contain any other elements, and hence, meets Applicant's "consisting of" language.

Erickson teaches (see col 11, line 63 to col 12, line 21) that the alloy is treated to produce primary gamma prime particles and also secondary gamma prime particles with an ultra-fine size. Thus, Erickson teaches an alloy with a gamma prime morphology with a bimodal γ' distribution.

Though Erickson teaches (see col 37, lines 55-58) that the alloy is subjected to HIP (hot isostatic pressing) in order to facilitate "nearly complete pore closure" Erickson does not teach a step of HIPing that is at a pressure similar to that of the present invention. The "nearly complete pore closure" of Erickson does not mean pore-free.

Kenton teaches (see abstract) a method of removing cast defects, such as micropores, in superalloys by subjecting the alloy to an HIP treatment. Kenton teaches (see col 5, lines 58-68) that the HIP treatment occurs at 1800-2350°F at 5-50 ksi. This treatment improves the mechanical properties of the alloy, including (see col 5, line 68 to col 6, line 17) the substantially complete removal of defects such as micropores.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the HIP treatment of Kenton to the alloy of Erickson because the HIP treatment of Kenton improves the mechanical properties of the alloy by removing casting defects such as pores (see abstract and col 5, line 68 to col 6, line 17). Thus, the alloy of Erickson in view of Kenton is pore-free.

Erickson in view of Kenton do not teach the sizes and volume percent distribution of the γ' precipitates as claimed. However, given the teaching of Erickson (see col 11, line 66 to col 12, line 21), it would have been within the expected skill of a routineer in

the art to adjust the γ' aging condition in order to obtain a desirable γ' particle size such as that disclosed by DeLuca et al.

DeLuca et al teach (see abstract) forming a bimodal γ' precipitate distribution in a nickel base superalloy. The large particles had (see col. 3, lines 29-45) size of about 5-15 microns and were preferably present (see claim 6) at about 30-40% by volume. The small cuboidal particles have size of about 0.3-0.7 microns.

Therefore, it would have been obvious to one of have incorporated the bimodal γ' precipitate distribution of DeLuca et al in the alloy of Erickson because the bimodal γ' distribution provides (see abstract) a microstructure that was damage tolerant, thus leading to a longer workpiece lifetime.

Regarding claims 4 and 11, DeLuca et al teach (see col. 3, lines 33-34) that the smaller γ' precipitates are cuboidal in shape. DeLuca et al teach (see col. 3, lines 44-45) that the large γ' precipitates have a branched configuration with three or four branches. The four-branched precipitates are "octet-shaped" precipitates as claimed.

Regarding claim 5, Erickson teaches (see title) that the superalloy is a single crystal.

Regarding claims 6, 10 and 24, Erickson teaches (see col 11, line 63 to col 12, line 21) that the alloy is treated to produce primary gamma prime particles and also secondary gamma prime particles with an ultra-fine size. Thus, Erickson teaches an alloy with a gamma prime morphology with a bimodal γ' distribution. Combined with the teachings of DeLuca et al (specifically in the abstract and col. 3, lines 46-50) of restraining crack propagation, one of ordinary skill in the art would have expected the

alloy of Erickson in view of Kenton and DeLuca et al to have the ability to resist initiation and subsequent propagation of fatigue cracks in a hydrogen environment as claimed.

Regarding claims 7-9, Erickson in view of Kenton do not teach the sizes and volume percent distribution of the γ' precipitates as claimed. However, given the teaching of Erickson (see col 11, line 66 to col 12, line 21), it would have been within the expected skill of a routineer in the art to adjust the γ' aging condition in order to obtain a desirable γ' particle size such as that disclosed by DeLuca et al.

Regarding claim 25, see above regarding claims 4 and 24.

Regarding claim 26, see above regarding claims 1 and 24.

Regarding claims 27 and 28, the nickel base superalloy of Erickson in view of Kenton and DeLuca et al contained the claimed composition, was pore free and was eutectic γ–γ' free. The four-branched precipitates read on the "octet-shaped" precipitates, which Applicant disclosed (see page 5) as being the means for impeding preferential cracking in the γ matrix phase. Therefore, the prior art meets the limitations of this claim.

(10) Response to Argument

Appellant has argued that:

(a) Erickson fails to meet the claim feature of less than 5.0 wt% rhenium.

In response, Erickson teaches including from about 5.0 to 7.0 wt% rhenium. Per established case law, see MPEP 2144.05, such a disclosure in the prior art is sufficient to provide a *prima facie* case of obviousness absent a showing of unexpected results. Appellant has failed to provide any such showing.

(b) Kenton does not teach forming an article having the claimed composition that is pore free.

In response, it is noted that the teachings of Kenton relate to treatment methods for "age-hardenable alloy parts having melting points in excess of 1000°C, in particular high temperature superalloys", for the purpose of improving mechanical properties by applying a specific HIP treatment. One of ordinary skill in the art would have been led to apply the HIP treatment to superalloy compositions, even those not expressly disclosed by Kenton, for the same purpose.

(c) Erickson fails to teach that the formed article was eutectic γ-γ' free.

In response, Erickson teaches (see cols. 11-12 and Table 4) that full solutioning was desired. Erickson teaches (in the examples in Table 4) various embodiments that achieve 100% solutioning. This solutioning step removes eutectic γ-γ' from the article. With respect to Appellant's remarks regarding the examples that achieve 100% solutioning required less than 3 wt% Cr, (1) Appellant's claims include 3.0 wt% Cr, (2) Erickson did not assert any relationship between solutioning and Cr content and (3)

example 10D (including 4 wt% Cr) achieved "99.9-100" solutioning. The Examiner believes that "99.9-100" means that different articles made of the alloy achieved different amounts of solutioning and that Erickson gave the range achieved by the different articles. Thus, some of the articles made with Cr within the presently claimed range of 3-12 wt% were able to obtain 100% solutioning, i.e.-eutectic γ-γ' free.

(d) DeLuca et al relate to the treatment of alloys which do not contain rhenium. In response, it is important to note that in the discussion of the "Disclosure of Invention" and "Best Mode for Carrying Out the Invention" sections of DeLuca et al, all of the discussions relate to the bimodal/trimodal distribution of particles being "applicable to single crystal nickel base superalloys" (col. 3, lines 51-53) and can be "produced by heat treating a single crystal or columnar grain nickel base superalloy so as to produce two or more distinct size groups of γ' particles in a γ matrix" (col. 4, lines 56-59). No mention is made of specific nickel base superalloys until the examples provided by DeLuca et al. Thus, Appellant's argument is not found persuasive because DeLuca et al teach that the bimodal/trimodal distribution of γ' particles was applicable to nickel base superalloys, which genus includes the nickel base superalloy disclosed by Erickson.

(e) DeLuca et al relate to the formation of trimodal γ' distributions.

In response, Appellant's attention is directed to the paragraph spanning cols. 4 and 5 and the proceeding paragraph. Here, DeLuca et al discuss that it is the large branched γ' particles in combination with the smaller cuboidal γ' particles achieve crack

propagation resistance, and that the fine spheroidal γ' particles were not necessary to achieve the crack propagation resistance.

(f) None of the references teach or suggest large octet shaped particles, particularly the "four branched" γ' particles of DeLuca et al do not necessarily have eight sides.

In response, Appellant's attention is directed to various micrographs that are of record in this application. Particularly the micrographs present in DeLuca et al (figures 3A, 3B) and the micrographs submitted by Appellant on 22 August 2005. When comparing the "four-branched" γ' particles achieved by DeLuca et al and the "octet-shaped" γ' particles of Appellant's invention, the examiner finds that the shapes of the two particles are identical. Appellant has provide no evidence to the contrary and appears to be merely arguing that DeLuca et al did not name the γ' particles produced the same thing as Appellant is naming the particles.

(g) The Examiner never addressed the issue of how one would modify Erickson to perform both the processing of Kenton and the heat treatments of DeLuca et al, which treatments are quite different from each other.

In response, one of ordinary skill in the art would merely have replaced the HIP treatment of Erickson with the HIP treatment of Kenton, and replaced the aging treatments of Erickson with the aging treatment of DeLuca et al. One of ordinary skill in the art would not have been confused by simple substitution of the equivalent heat treatments.

(h) The combination of Erickson with Kenton and DeLuca et al do not teach or suggest a superalloy capable of resisting initiation and subsequent propagation of fatigue cracks.

In response, please see col. 4, line 56 to col. 5, line 14 of DeLuca et al. DeLuca et al teach that the bimodal distribution of γ' particles was utilized to prevent crack formation and propagation.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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